

# Modelling the distribution of cetaceans using opportunistic presence-only data in São Miguel Island (Azores)



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## INTRODUCTION

The MONICET Project is collaborative research project focused on data collection and validation from Whale Watching commercial operations in the Azores Islands. In order to demonstrate and study the possibilities of this kind of opportunistic data we started to implement different kinds of presence-only modelling approaches to study their performance.

## METHODOLOGY

The target specie used was the Sperm Whale (*Physeter macrocephalus*), with a total of 554 presence points recorded in 2010. Various bathymetric-derived variables were used (fig.1), in order to detect the most important factors and specific features influencing the species distribution. We applied two different models to obtain Habitat Suitability Maps: (1) the MAXimum ENTropy model and (2) the Genetic Algorithms For Rule Production with the Best Subsets.

### Model Specifications:

MAXENT: Using Maxent software for species habitat modeling 3.3.3e, with Autofeatures. A 10-fold cross-validation, with Random Seeds and with a 20% of test data was performed.

GARP: Using the new OpenModeller implementation of the GARP with the Best Subsets, a 50% of training data and a 50% threshold.

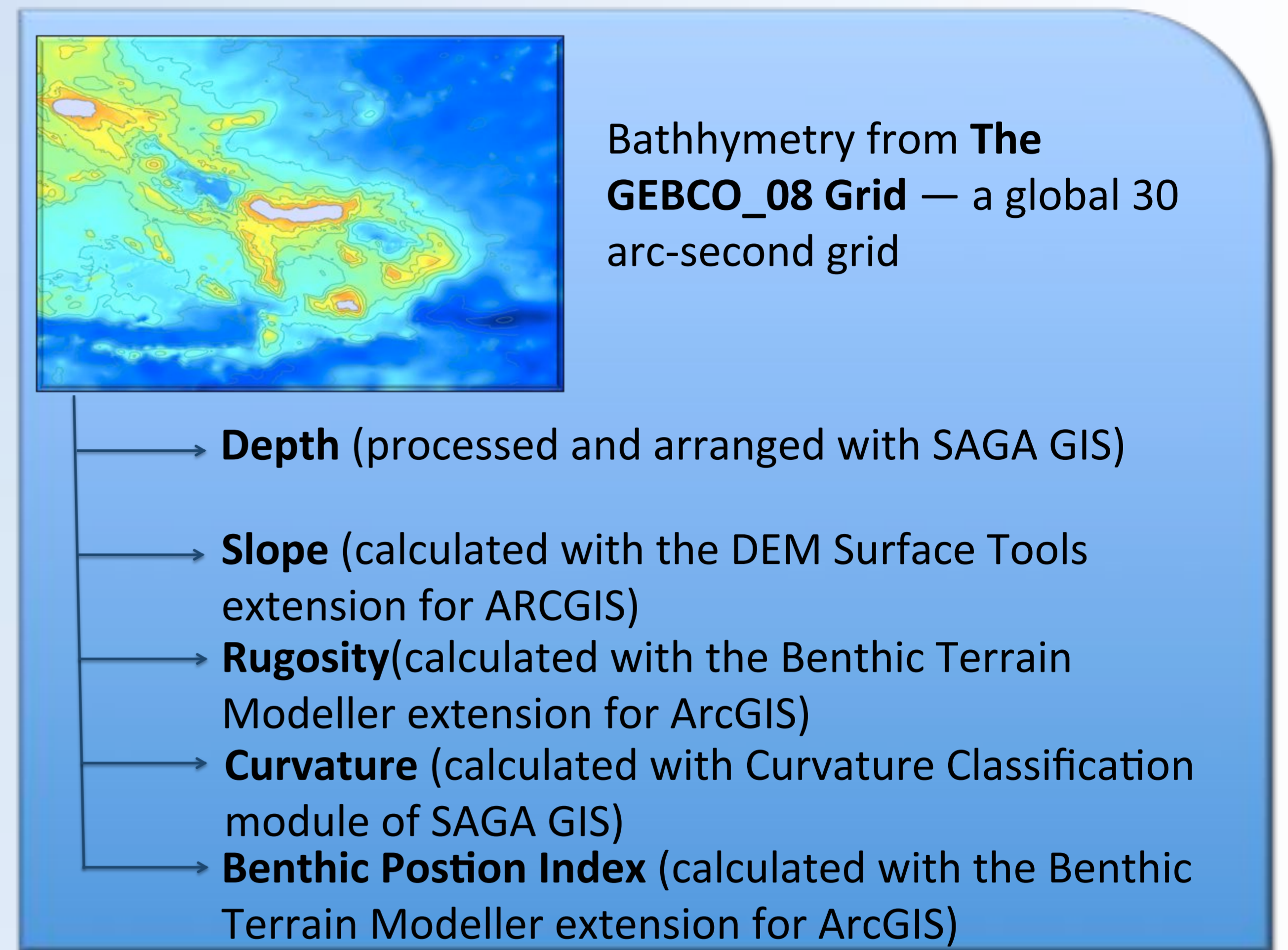


Figure 1. Eco-geographical variables used in the modelling. Three non-usual variables were used in order to detect smaller topographic features (such as submarines ridges and valleys).

## RESULTS

Both algorithms performed quite well, with AUC values over 0.8, which indicates a good prediction and a low omission rate, producing reasonable Habitat Suitability Maps (fig.2). The most significant variable according to the jackknife analysis for the MAXENT model was the depth, followed by the slope (fig.3).

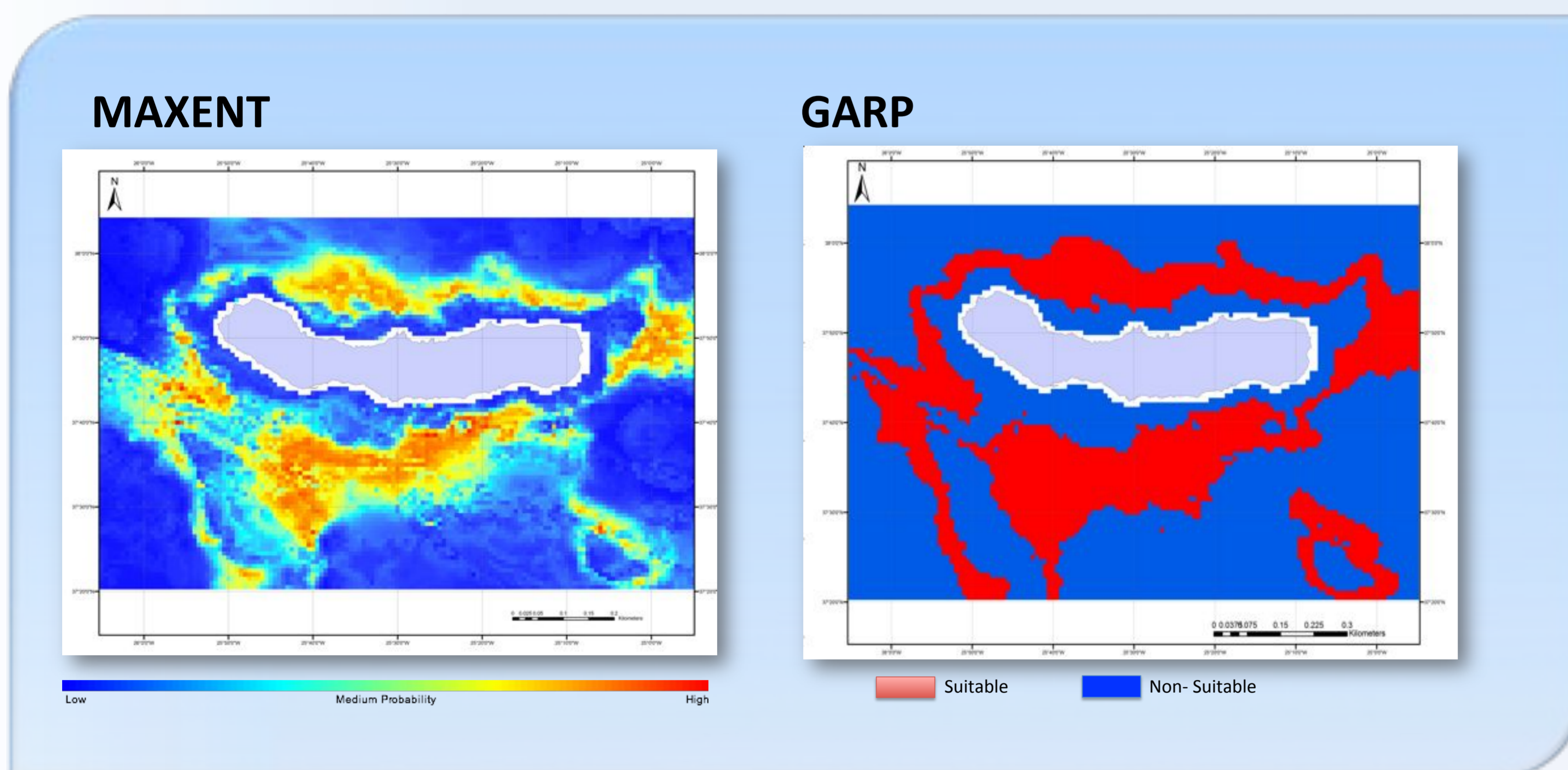


Figure 2. Habitat Suitability Maps for *P. macrocephalus*

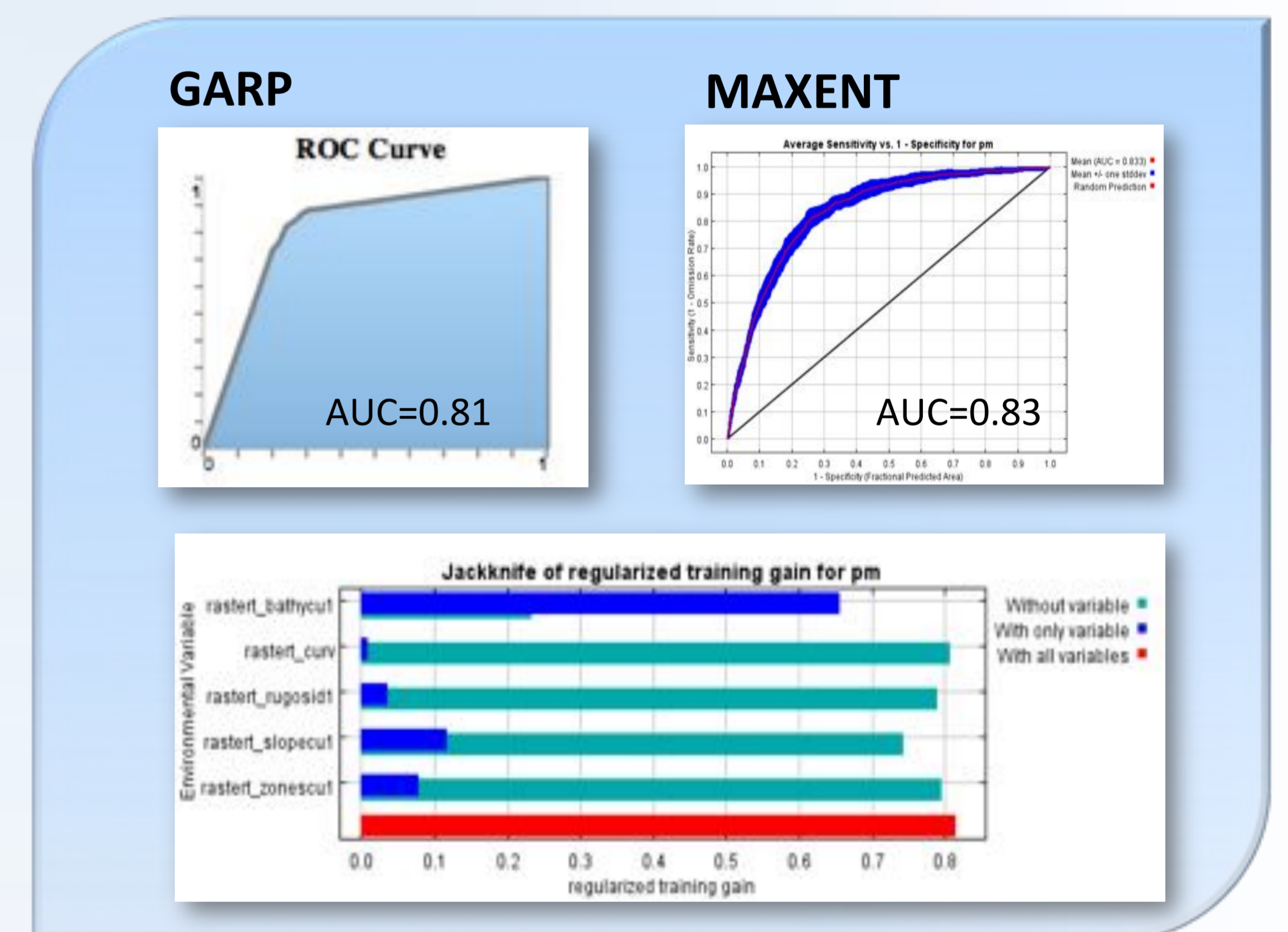


Figure 3. Quantitative results. ROC curves at the top and jackknife test results at the bottom.

## CONCLUSION

- Presence-only models seem to work well and produce realistic results with Whale Watching data.
- In order to avoid an excessive overfit, few extra data over a wider range would be needed.
- Bathymetry seems to be the most important variable, but more work needs to be done on tuning the variables.

### Acknowledgments:

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- (1) Phillips, S., Anderson, R., & Schapire, R. (2006). Maximum entropy modeling of species geographic distributions. *Ecological Modelling*, 190 (3-4), 231-259. (2) Anderson, R. P., D. Lew, and A. T. Peterson. 2003. Evaluating predictive models of species' distributions: criteria for selecting optimal models. *Ecological Modelling*, v. 162, p. 211-232.





**ABSTRACT BOOK**

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LONG-TERM DATASETS ON MARINE MAMMALS:  
LEARNING FROM THE PAST TO MANAGE THE FUTURE

21<sup>st</sup> – 23<sup>rd</sup> MARCH 2011, CADIZ, SPAIN





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## MODELLING THE DISTRIBUTION OF CETACEANS USING OPPORTUNISTIC PRESENCE-ONLY DATA IN S.MIGUEL ISLAND (AZORES)

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The distribution of cetaceans has always been a difficult and polemic issue, and more so in open waters and pelagic habitats. Due to the high economic cost of surveying and the low detectability of certain cetacean species, the distribution of many cetacean species remains poorly known in many areas. In this work we explore the potential of Spatial Distribution Modelling using presence-only models to obtain a potential distribution map of cetacean populations from opportunistic data. We used opportunistic data from the MONICET database, provided by commercial whale-watching operations in the Azores using a standard, validated, methodology. Two different presence-only models were applied, the Genetic Algorithm for Rule-Set Production (GARP) and the Maximum Entropy Modelling (MaxEnt). Using different GIS programs we prepared a set of different bathimetric derived ecogeographical variables: Depth, Slope, Rugosity and Bathimetric Position Index, using the Bathimetric Terrain Modeller Extension for ArcGIS to calculate the last two. A comparison of the performance of the two different models was carried out, using the Area Under the Curve (AUC) of the Receiver Operator Curve (ROC) and expert knowledge as key factors to see which one of the models produce more realistic results. The relevance of each variable in the models was evaluated using a Jackknife test. The results of this study could be used in a future for a conservation and management purposes in the Azorean waters.